

### CLAIMS

1 – Active chamber engine comprising at least one piston (1) sliding in a cylinder (2) controlled by a device for stopping the piston at top dead centre and supplied with compressed air or any other gas at high pressure contained in a storage reservoir (22) which is reduced to an average pressure called the working pressure in a work capacity (19) preferably through a dynamic pressure reducing valve characterized:

- In that the expansion chamber consists of a variable volume fitted with the means to produce work and that is joined to and in contact with the space contained above the main engine piston by means of a permanent passage(12),

- In that when the piston is stopped at top dead centre, the air or gas under pressure is admitted into the expansion chamber when this is at its smallest volume and, under the thrust of this air under pressure, increases its volume by producing work,

- In that the expansion chamber being maintained at very nearly its maximum volume, the compressed air contained within then expands into the engine cylinder thus pushing the engine piston downwards along its travel by in turn supplying work,

- In that during the upwards travel of the engine piston during the exhaust stroke, the variable volume in the expansion chamber is returned to its smallest volume to restart the complete work cycle.

2 – Active chamber engine according to claim 1 characterized in that the work cycle of the active chamber with regard to the cycle of the engine piston comprises three phases such that:

- When the engine piston is stopped at top dead centre: admission of a charge into the active chamber producing work by increasing its volume,

- During the expansion travel of the engine piston: maintenance at a predetermined volume which is the actual volume of the expansion chamber,

- During the exhaust stroke of the engine piston: repositioning of the active chamber to its minimum volume to enable the cycle to be renewed.

3 – Active chamber engine according to claims 1 and 2 for which the operating thermodynamic cycle in compressed air mono-energy mode is characterized by an isothermal expansion without work with conservation of energy, carried out between the high pressure compressed air storage reservoir and the work capacity, followed by a transfer accompanied by a very slight expansion in the pressure cylinder known as quasi-isothermal with work, then a polytropic expansion with work in the engine cylinder and lastly an exhaust at atmospheric pressure i.e. four phases as follows:

- An isothermal expansion without work,
- A transfer – slight expansion with work known as quasi-isothermal,
- A polytropic expansion with work,
- An exhaust at ambient pressure.

4 – Active chamber engine according to claims 1 to 3 characterized in that the work capacity (19) comprises a device (25,26) for heating the compressed air with a supplementary energy provided by fossil or other fuel, the said device increasing the temperature and/or pressure of the air passing through it.

5           5 – Active chamber engine according to claim 4 characterized in that the compressed air is heated by the combustion of fossil or biological fuel directly in the compressed air, the engine then being said to be of the external internal combustion type.

10           6 – Active chamber engine according to claim 4 characterized in that the compressed air contained in the work capacity is heated by the combustion of fossil or biological fuel in a heat exchanger, the flame not coming into direct contact with the compressed air, the engine then being said to be of the external-external combustion type.

15           7 – Active chamber engine according to any of claims 4 to 6 characterized in that the thermal heater uses a thermochemical gas solid reaction process based on the transformation by evaporation of a reagent fluid contained in an evaporator, for example liquid ammonium or a gas which reacts with a solid reagent contained in a reactor, for example salts such as calcium, magnesium or barium chlorides or others whose chemical reaction produces heat and which, when the reaction has finished can be regenerated by heating the reactor which cases the desorption of the gaseous ammonium which  
20 recompenses in the evaporator.

25           8 – Active chamber engine according to any of claims 4 to 7 whose thermodynamic cycle when working in bi-energy mode with supplementary energy is characterized by an isothermal expansion without work with conservation of energy carried out in the work capacity by an increase in temperature by the heating of the air by a fossil energy followed by a very slight expansion known as quasi-isothermal with work, a polytropic expansion with work in the engine cylinder and lastly an exhaust at atmospheric pressure representing 5 successive phases as follows:

- An isothermal expansion,
- An increase in temperature,
- 30           - A transfer – slight expansion with work known as quasi-isothermal,
- A polytropic expansion with work,
- An exhaust at ambient pressure.

35           9 – Active chamber engine according to any of the claims above characterized in that the torque and the speed of the engine are controlled by controlling the pressure in the work capacity (19).

10 – Active chamber engine according to any of the claims above characterized in that during operation in bi-energy mode with supplementary energy, an electronic computer controls the quantity of energy used according to the pressure of the compressed air therefore the mass of the air introduced into the said work capacity.

11 – Active chamber engine according to any of the claims above characterized in that the volume of the active chamber is made up of a piston (14) called the pressure piston sliding in a cylinder (13) and connected by a connecting rod (15) to the crank of the engine (9) according to a classic drive sequence.

5           12 – Active chamber engine according to claim 11 characterized in that the travel of the pressure piston (14) is determined such that when the volume chosen as volume of the chamber has been reached and during the downward travel of the engine piston (1), the pressure piston (14) finishes its downward travel and starts its upward travel so as to reach its top dead centre approximately at the same time as the engine piston reaches its  
10 top dead centre.

13 - Active chamber engine according to any of the claims above characterized in that to enable autonomous operation of the engine during its use with supplementary energy and/or when the compressed air storage reservoir (22) is empty, the active chamber engine according to the invention is connected to an air compressor (27) to  
15 supply compressed air to the high pressure compressed air storage reservoir (22).

14 – Active chamber engine according to claim 13 above characterized in that the air compressor (27) directly supplies the work capacity (19). In this case, the engine is controlled by controlling the pressure of the compressor (27) and the dynamic pressure reducing valve (21) between the high pressure storage reservoir and the work capacity  
20 remains blocked off.

15 – Active chamber engine according to claims 13 and 14 characterized in that the coupled air compressor (27) supplies simultaneously or successively in combination the storage reservoir (22) and the work capacity (19).

25 16 - Active chamber engine according to any of the claims above characterized by a mono-energy operation with a fossil fuel (or other), the work capacity (19) being supplied only by the coupled air compressor (27), the high pressure compressed air storage reservoir being purely and simply omitted.

17 – Active chamber engine according to claim 6 and any one of claims 13 to 16 characterized in that the exhaust after expansion is recalcuated to the inlet of the coupled  
30 air compressor.

18 - Active chamber engine according to any of the claims above working in compressed air mono-energy mode characterized in that the engine is comprised of multiple expansion stages of increasing cylinder sizes each stage comprising an active chamber according to the invention and in that, between each stage a heat exchanger  
35 (29) is positioned to heat the exhaust air from the previous stage.

19 – Active chamber engine according to claim 18 operating in bi-energy mode characterized in that the heat exchanger positioned between each stage is fitted with a heating device running on supplementary energy.

20 – Active chamber engine according to claims 18 and 19 characterized in that the heat exchangers and the heating device are combined together or separately in a multiple stage device using the same energy source.